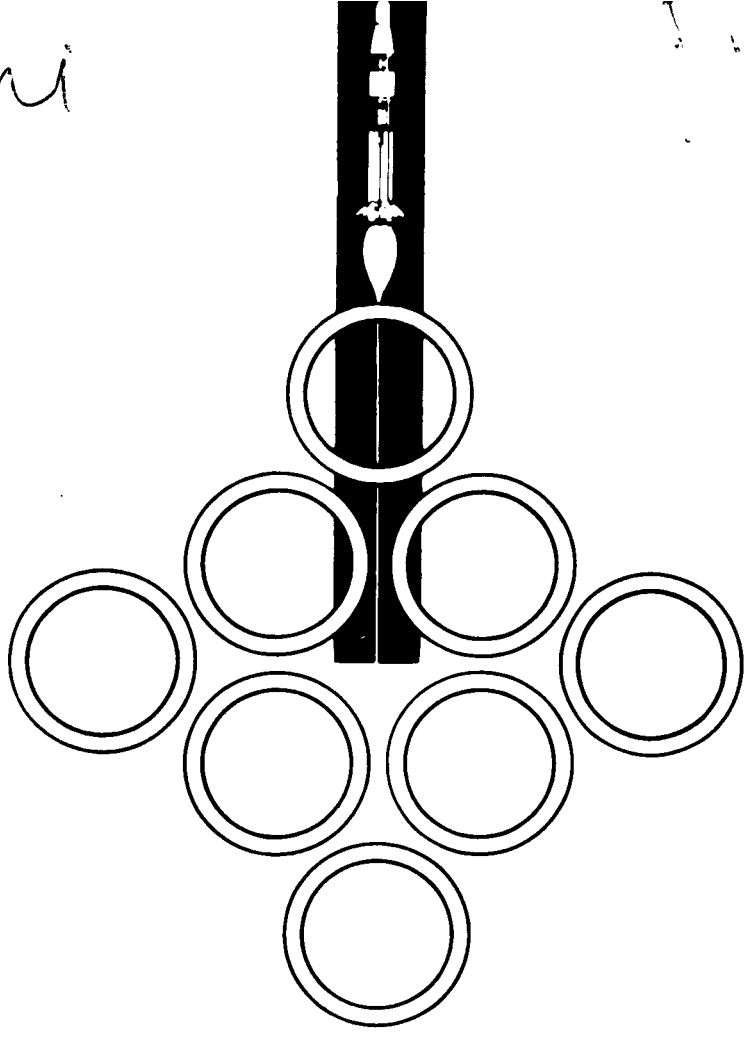


ENGINEERING DEPARTMENT

# TECHNICAL REPORT

TR-RE-CCSD-FO-1075-3

March 31, 1967

# SATURN IB PROGRAM

## TEST REPORT
## FOR

RELIEF VALVE, 1½ BY 2-INCH, 300 PSIG

Crosby-Ashton Part Number JMC-C, Type A

NASA Drawing Number 75M04406 PCN-1



SPACE DIVISION CHRYSLER CORPORATION

# TEST REPORT

FOR

RELIEF VALVE, 1½ BY 2-INCH, 300 PSIG

Crosby-Ashton Part Number JMC-C Type A

NASA Drawing Number 75M04406 PCN-1



## ABSTRACT

This report presents the results of tests performed on 1 specimen of Relief Valve 75M04406 PCN-1. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional

The test specimen failed to meet the requirements of specification 75M04406 PCN-1.

A leak developed during proof pressure testing. The leak was in the protective cover for the adjusting bolt assembly. During the functional test, when pressurized with $GN_2$ at 50 psig through the inlet port, the specimen leaked through the exit port. No leakage is allowed until 280 psig is attained. The specimen was disassembled and cleaned. When retested, the inlet port was pressurized to 112 psig and the specimen leaked through the exit port. The specimen was returned to the vendor for rework.

When the specimen was returned from the vendor, the specimen was again tested and leaked through the exit port when the inlet port was pressurized to 175 psig. Cause of the malfunction was attributed to a defective seat. Testing was discontinued at this point.

TR-RE-CCSD-FO-1075-3

# TEST REPORT

FOR

RELIEF VALVE, 1½ BY 2-INCH, 300 PSIG

Crosby-Ashton Part Number JMC-C Type A

NASA Drawing Number 75M04406 PCN-1

March 31, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

# FOREWORD

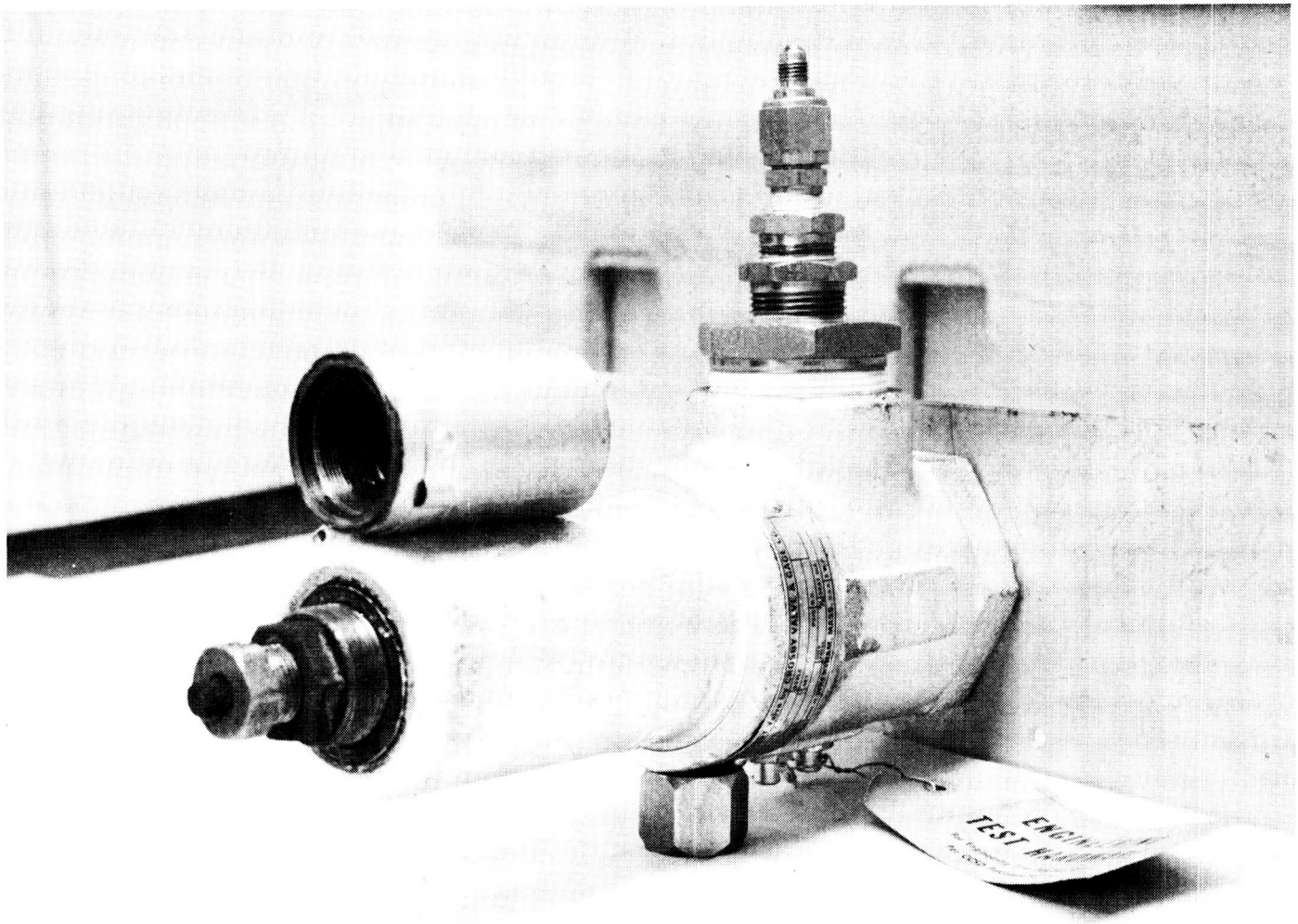
The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

TABLE OF CONTENTS

## LIST OF ILLUSTRATIONS



## LIST OF TABLES



Relief Valve 75M04406 PCN-1

CHECK SHEET

FOR

RELIEF VALVE, 1½ BY 2-INCH, 300 PSIG

MANUFACTURER: Crosby-Ashton Company
MANUFACTURER'S MODEL NUMBER: JMC-C Type A
NASA PART NUMBER: 75M04406 PCN-1
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

| | | |
|---|---|---|
| A. | OPERATING MEDIUM: | Freon-22 |
| B. | OPERATING PRESSURE: | 300 psig |
| C. | BURST PRESSURE: | 1200 psig |

II. CONSTRUCTION

| | | |
|---|---|---|
| A. | BODY MATERIAL: | Carbon steel |
| B. | SPRING MATERIAL: | Carbon steel, cadium plated |
| C. | SEAT MATERIAL: | Stainless steel, type 325 |
| D. | INLET SIZE: | 1½-inch NPT |
| E. | OUTLET SIZE: | 2-inch NPT |

III. ENVIRONMENTAL CHARACTERISTICS

| | | |
|---|---|---|
| A. | TEMPERATURE RANGE: | From 5 to 240°F |
| B. | SALT SPRAY: | 24 hours |
| C. | LIFE CYCLE: | 500 cycles |

IV. LOCATION AND USE:

The relief valve is used on the air conditioning unit condensor of the Environmental Control System, Saturn S-IB Ground Support Equipment.

TEST SUMMARY

RELIEF VALVE, 1½ BY 2-INCH, 300 PSIG

75M04406 PCN-1

| Environment | Units | Operational Boundary | Test Objective | Test Results | Remarks |
|---|---|---|---|---|---|
| Receiving Inspection | 1 | Comply with NASA drawing 75M04406 PCN-1 | Determine compliance with NASA and vendor drawings for defects or poor workmanship. | Satisfactory | |
| Proof Pressure Test | 1 | 450 psig | Check for leakage | Satisfactory | No leakage affecting performance |
| Initial Functional Test | 1 | Cracking pressure of 295 psig; Reseat 85% of cracking pressure. Zero leakage at 95% of cracking pressure | Determine cracking and reseat pressure Check repeatability and monitor for leakage. | Unsatisfactory | Valve leaked through seat. Testing was discontinued after two corrective attempts were unsuccessful. |

# SECTION I

# INTRODUCTION

## 1.1 SCOPE

This report presents the results of tests that were performed to determine if Relief Valve 75M04406 PCN-1 meets the operational requirements for John F. Kennedy Space Center Launch Complexes 34 and 37B. A summary of the test results is presented on page vii.

## 1.2 ITEM DESCRIPTION

One specimen of Relief Valve 75M04406 PCN-1 was tested. The valve is used in the environmental control system to relieve excessive pressure in the air conditioning condenser.

Relief Valve 75M04406 PCN-1 is manufactured by Crosby-Ashton as vendor part number JMC-C, Type A. The inlet port is $1\frac{1}{2}$-inches in diameter and the vent port is 2-inches in diameter. The valve is adjusted to relieve at 295 psig.

## 1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Relief Valve 75M04406 PCN-1.

a. 75M04406 PCN-1, Component Specifications
b. KSC-STD-164(D), Environmental Test Methods
c. Test Plan CCSD-FO-1075-1F, Test Requirements
d. Test Procedure CCSD-FO-1075-2F

# SECTION II

# RECEIVING INSPECTION

## 2.1 TEST REQUIREMENTS

The relief valve shall be visually and dimensionally inspected for conformance with NASA drawing 75M04406 PCN-1 and applicable specifications to the extent possible without disassembly of the test specimen. The specimen shall also be inspected for poor workmanship and manufacturing defects.

## 2.2 TEST PROCEDURE

A visual and dimensional inspection of the test specimen was performed to determine compliance with NASA drawing 75M04406 PCN-1 and applicable vendor drawings to the extend possible without disassembly of the test specimen. At the same time the test specimen was also inspected for poor workmanship and manufacturing defects.

## 2.3 TEST RESULTS

The specimen complied with NASA drawing 75M04406 PCN-1. No evidence of poor workmanship or manufacturing defects was observed.

## 2.4 TEST DATA

The data presented in table 2-1 were recorded during the inspection.

Table 2-1. Specimen Specifics

| | |
|---|---|
| Name | Relief Valve |
| Manufacturer | Crosby-Aston |
| Model No. | JMC-C |
| Type | A |
| Cracking Pressure | 295 psig |
| Inlet Port Size | $1\frac{1}{2}$-inches |
| Outlet Port Size | 2-inches |

## SECTION III

## PROOF PRESSURE TEST

### 3.1 TEST REQUIREMENTS

3.1.1 The specimen shall be subjected to a proof pressure of 450 psig for 5 minutes.

3.1.2 The specimen shall be checked for leakage and distortion.

### 3.2 TEST PROCEDURE

3.2.1 The test setup was assembled as shown in figure 3-1 using the equipment listed in table 3-1.

3.2.2 All hand valves were closed and regulators were adjusted to zero outlet pressure. The inlet port of hand valve 4 was pressurized to 500 psig.

3.2.3 Hand valves 4 and 6 were opened and gage 7 was monitored.

3.2.4 Hand valves 9 and 10 were opened and regulator 8 was adjusted until 450 psig was indicated on gage 11.

3.2.5 Hand valve 9 was closed. Pressure was maintained for 5 minutes. Gage 11 was monitored for an indication in pressure drop.

3.2.6 Specimen pressure was recorded at the beginning and end of the pressurizing period.

3.2.7 Upon completion of the leakage check, hand valve 9 was opened and regulator 8 was adjusted for zero outlet pressure.

3.2.8 Hand valve 12 was opened and the pressure on the specimen was relieved.

### 3.3 TEST RESULTS

During exposure to 450 psig a leak developed at the cap gasket. The cap is normally exposed to atmospheric pressure only and serves as a protective cover for the adjusting bolt assembly. A leak in this assembly does not affect the performance of the valve, therefore testing was continued.

### 3.4 TEST DATA

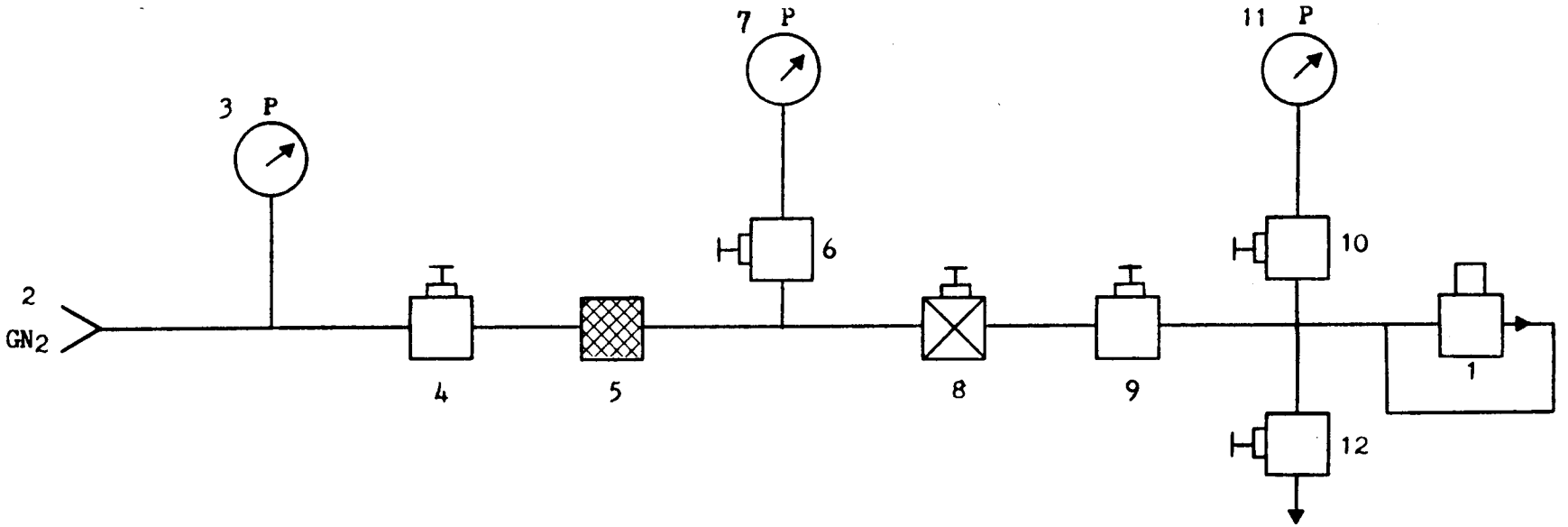
The data presented in table 3.2 were recorded during the test.

Table 3-1. Proof Pressure Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Crosby-Ashton | JMC-C Type A | NA | Relief valve, 1½ by 2-inch, 300-psig |
| 2 | $GN_2$ Pressure Source | CCSD | NA | NA | 5000-psig |
| 3 | Pressure Gage | Duragauge | 1057-S | NASA 08-113-200-611-H | 0-to 5000-psig ±0.5% FS Cal date 9/28/66 |
| 4 | Hand Valve | Robbins Aviation | SSTG-250 4T | NA | ¼-inch |
| 5 | Filter | Bendix | | NA | 2-micron |
| 6 | Hand Valve | Robbins Aviation | SSTG-250 4T | | ¼-inch |
| 7 | Pressure Gage | Duragage | NA | NASA 08-113-200- | 0-to 5000-psig ±0.5% FS Cal date 9-28-66 |
| 8 | Pressure Regulator | Tescom | 26-1003 | 322 | 6000-psig inlet 4000-psig outlet |
| 9 | Hand Valve | Robbins Aviation | SSTG-250 4T | NA | ¼-inch |
| 10 | Hand Valve | Robbins Aviation | SSTG-250 4T | NA | ¼-inch |
| 11 | Pressure Gage | Heise | H-358-33 | NASA 08-113-200-601-B | 0-to 1000-psig ±0.1% FS Cal date 9-28-66 |
| 12 | Hand Valve | Robbins Aviation | SSTG-250 | NA | ¼-inch |

Table 3-2. Proof Pressure and Leakage Data

| | |
|---|---|
| Pressure | 450 psig for 5 minutes |
| Leakage | None affecting performance of valve |
| Distortion | None |




Note: All lines ¼ inch.
Refer to table 3-1 for item identification.

Figure 3-1. Proof Pressure Test Schematic

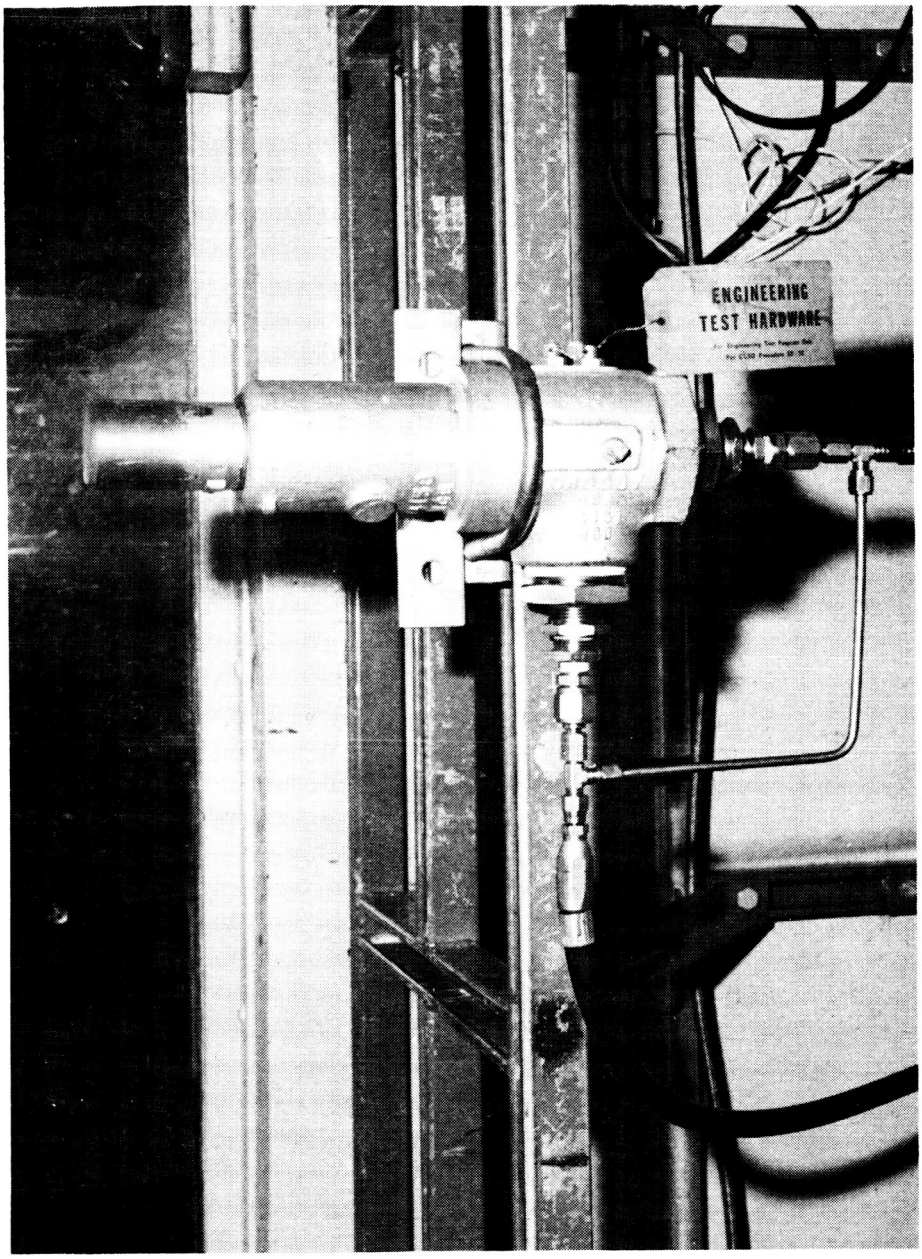



Figure 3-2. Proof Pressure Test Setup

## SECTION IV

## FUNCTIONAL TEST

### 4.1 TEST REQUIREMENTS

4.1.1 A functional test shall be performed on the specimen.

4.1.2 The cracking and reseating pressures of the specimen shall be measured. The cracking pressure shall be 295 psig.

4.1.3 The specimen shall be checked for internal and external leakage at 95 per cent of the cracking pressure.

### 4.2 TEST PROCEDURE

4.2.1 The test setup was assembled as shown in figure 4-1 using the equipment listed in table 4-1.

4.2.2 All connections were tight, all gages were installed and operating properly, and all valves were closed.

4.2.3 Hand valves 2, 9, and 10 were fully opened. Gage 4 was monitored.

4.2.4 Regulator 5 was adjusted to an outlet pressure of 330 psig as indicated on gage 6.

4.2.5 Hand valve 7 was opened and the pressure indicated on gages 6, 13, and 18 were permitted to equalize.

4.2.6 Hand valve 14 was gradually opened to permit a slow pressure rise at the specimen. The pressure was monitored on gage 16.

4.2.7 The increase in pressure was continued until bubbles appeared in water bath 17. The appearance of bubbles in water bath 17 indicated that the cracking pressure of the valve has been exceeded by a small amount.

4.2.8 Hand valve 14 was closed and the pressure at which bubbles ceased to appear in water bath 17 was recorded. This was the reseat pressure of the specimen.

4.2.9 The test line was vented by opening hand valve 15.

4.2.10 Hand valve 15 was closed and steps 4.2.7 through 4.2.10 were repeated until a consistent cracking pressure was obtained.

4.2.11 Regulator 5 was adjusted until gages 6, 18, 13, and 16 all indicated a pressure of 95 per cent of cracking pressure. Evidence of leakage at beaker 17 was checked.

4.2.12 All data were recorded.

## 4.3 TEST RESULTS

4.3.1 The test system was leak checked with $GN_2$ prior to charging the system with Freon-22. The specimen leaked through the seat on all attempts of the leak check. Testing was discontinued after the specimen was returned from the vendor and the vendors rework failed to stop the seat leakage. A summary of the leak tests are presented in table 4-2.

Table 4-1. Functional Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Crosby-Ashton | JMC-C Type A | NA | Relief valve, 1½ by 2-inch, 300-psig |
| 2 | Hand Valve | CPV | 380-3 | NA | 1½-inch |
| 3 | Filter | Bendix | 2-S-13460 16-B-0 | NA | 2-micron absolute |
| 4 | Pressure Gage | Duragauge | NA | NASA 08-113-200-616-L | 0-to 5000-psig ±0.5% FS Cal date 12-20-66 |
| 5 | Pressure Regulator | Grove | 15-LX | 1008 | 0-to 6000-psig inlet 0-to 4000-psig outlet |
| 6 | Pressure Gage | Duragauge | NA | NASA 08-113-200-616-K | 0-to 5000-psig ±0.5% FS Cal date 1-9-67 |
| 7 | Hand Valve | Robbins | SSTG-250 4T | NA | ¼-inch |
| 8 | Freon-22 Accumulator | NA | NA | NA | 10-gallon |
| 9 | Hand Valve | Marotta | HVA-16 | | 1-inch |
| 10 | Hand Valve | Robbins | SSTG-250 4T | NA | ¼-inch |
| 11 | Heat Exchanger | NA | NA | NA | |
| 12 | Thermocouple | Honeywell | NA | NA | Cu-con |
| 13 | Pressure Gage | Duragauge | NA | NA | 0-to500-psig ±0.5% FS Cal date 10-24-66 |
| 14 | Hand Valve | Marotta | HVA-16 | | 1-inch |

Table 4-1. Functional Test Equipment List (Continued)

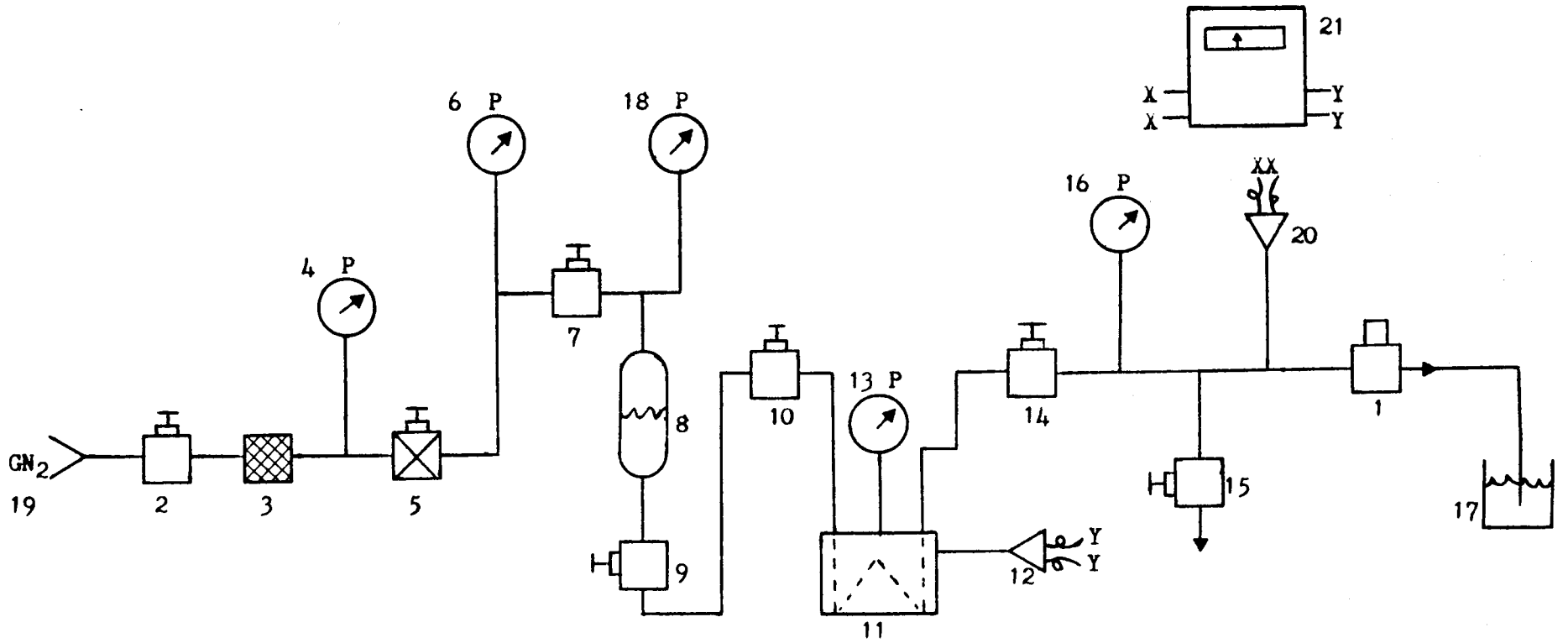
| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 15 | Hand Valve | Robbins | SSTG-250 4T | NA | ¼-inch |
| 16 | Pressure Gage | Heise | H 35957 | NASA 08-113-015-533 | 0-to 1000-psig ± 0.1% FS Cal date 1-17-67 |
| 17 | Water Bath | NA | NA | NA | Leak detector |
| 18 | Pressure Gage | Duragauge | NA | NASA 08-113-200-616-J | 0-to 500-psig ±0.5% FS Cal date 12-10-66 |
| 19 | $GN_2$ Supply | Laboratory Supply | NA | NA | 5000-psig |
| 20 | Thermocouple | Honeywell | NA | NA | T-type |
| 21 | Temperature Indicator | West | NA | NASA 08-113-019-461 | Cal date 10-3-66 |

Table 4-2. Functional Leak Check Summary

| Trial No. | Pressure Level | Results | Disposition |
|---|---|---|---|
| 1 | Inlet port pressurized to 50 psig. | Valve leaked at exit port | Valve was disassembled and cleaned. |
| 2 | Inlet port pressurized to 112 psig. | Valve leaked at exit port | Valve was returned to vendor for rework. |
| 3 | When returned from vendor valve was pressurized to 175 psig | Valve leaked at exit port. See table 4-3 for leakage values | Leakage through the seat was confirmed. Testing was discontinued. |

Table 4-3. Inlet Pressure versus Leakage Data

| Inlet Pressure (psig) | Leakage (scim) | Inlet Pressure (psig) | Leakage (scim |
|---|---|---|---|
| 150 | 0.0 | 250 | 1.0 |
| 175 | Trace | 275 | 9.0 |
| 200 | Trace | 280 | 30.0 |
| 225 | 0.2 | 290 | 350.0 |




Note: Refer to table 4-1 for item identification

Figure 4-1. Functional Test Schematic

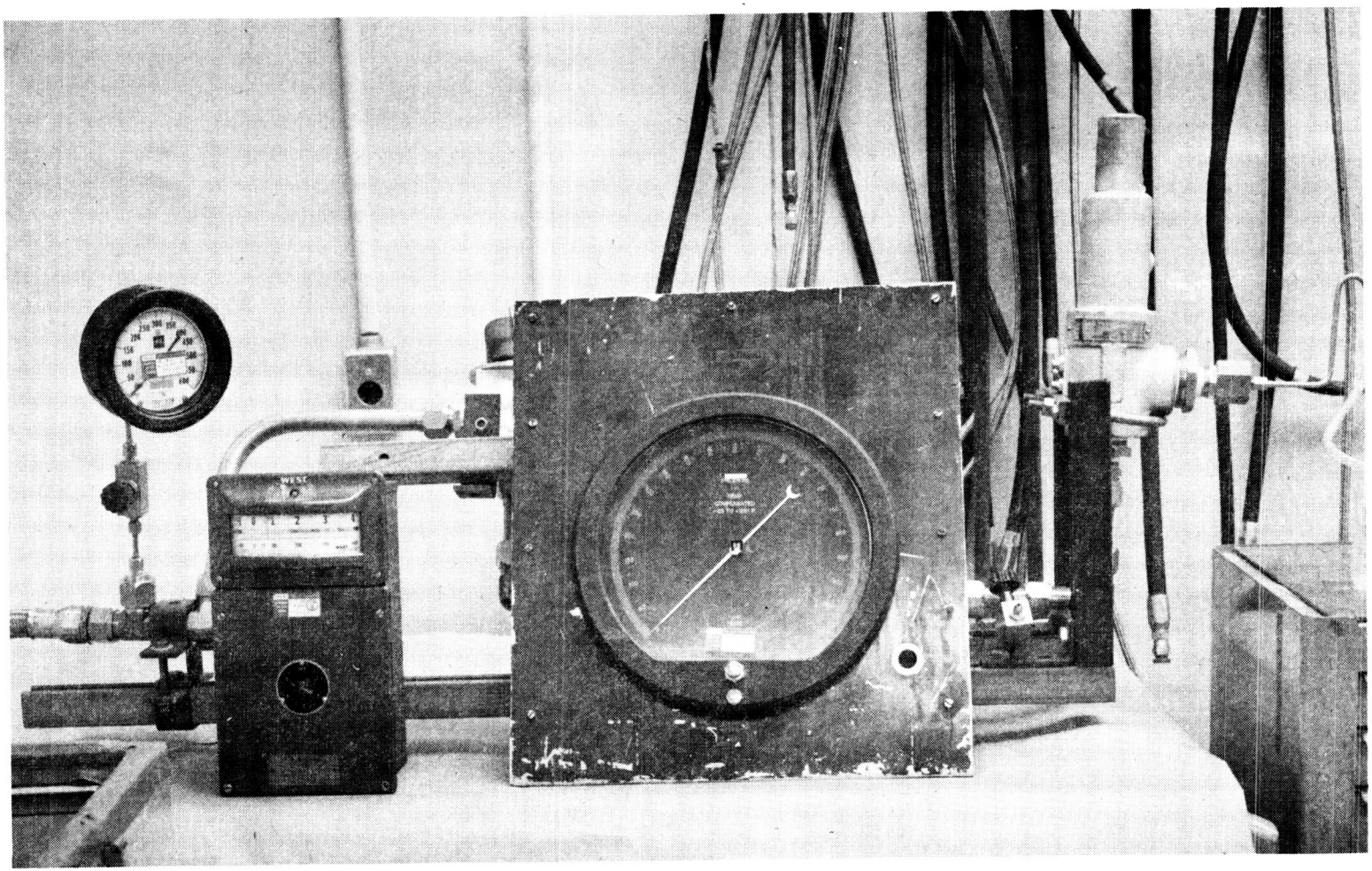


Figure 4-2. Functional Test Setup

APPROVAL

TEST REPORT

FOR

RELIEF VALVE, 1½ BY 2-INCH 300 PSIG

Crosby-Aston Part Number JMC-C, Type A

NASA Drawing Number 75M04406 PCN-1

SUBMITTED BY:

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